(IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH
Volume No.6, Issue No.6, October - November 2018, 8929-8932

Design And Construction Of Reinforced Concrete Frames Using Steel Bracings

CHAMARTHI MANIKUMAR
M. Tech student, Dept of CIVIL, AVN Institute of Engineering and Technology, Hyderabad, TS, India.

Dr. MD SUBHAN
Professor & HOD, Dept of CIVIL, AVN Institute of Engineering and Technology, Hyderabad, TS, India.

Abstract: **Steel braced frame is one of the structural structures used to face up to earthquake masses in multi-storied buildings. Many present strengthened concrete buildings need to retrofit to overcome the deficiencies to withstand seismic hundreds. The use of steel bracing systems for strengthening or retrofitting seismically inadequate strengthened concrete frames is a viable solution for reinforcing earthquake resistance. Bracing device reduces bending moments and shear forces within the columns. The lateral load is transferred to the foundation via axial action. Overall weight of the existing structure will not alternate appreciably after the software of the bracings. Metal bracing is least expensive, easy to erect, occupies less space and has flexibility to layout for assembly the desired electricity and stiffness. The bracing gadget improves not best the lateral stiffness and power capability however also the displacement capacity of the shape. Inside the present have a look at, the seismic overall performance of strengthened concrete (RC) homes rehabilitated using concentric steel bracing is investigated. The bracing is furnished for peripheral columns. a ten storey constructing is analyzed for seismic zone III as per IS 1893-2002 the usage of ETABS software program. The models are retrofitted with diverse metallic bracing structures on periphery columns storey wise and analyzed for seismic forces. The building is analyzed for models with Diagonal bracing, 'V' type bracing, Inverted 'V' type bracing, blended 'V' kind bracing, 'X' kind bracing, 'k' type bracing and in comparison with an un braced frame. The effectiveness of numerous forms of metallic bracing in rehabilitating a 10 storey constructing is tested. The impact of the distribution of the metallic bracing alongside the peak of the RC frame at the seismic performance of the rehabilitated building is studied. The principle parameters on this examine to examine the seismic analysis of homes are lateral displacement, storey go with the flow, axial forces inside the columns, Base shear. The percentage reduction in lateral displacement is observed out. It's far found that the 'X' sort of metal bracing extensively contributes to the structural stiffness and reduces the maximum storey drifts of the frames. The bracing systems enhance now not simplest the lateral stiffness however also the displacement capacity of the shape.**

Keywords: **ETABS, RC Frame, Steel Braced Frame, High Level Concrete, Stiffness, Strength,Shape.**

I. INTRODUCTION:

One of the simple, cheap and efficient methods for strengthening of reinforced concrete frames against lateral induced earthquake load is using steel cross bracings. The combination of reinforced concrete frame with steel cross bracing is not a common practice due to unknown behavior and performance that needs to be investigated. Research on the use of this method of retrofitting has begun since 80s in which cross bracings have been used indirectly together with a steel frame confined by a concrete frame. In addition to its great expenses and its possible unsuccessful economic justification, using this system may cause a dynamic interaction between steel bracing and concrete frames. Although in some cases, using additional steel frame to strengthen existing concrete frame, seems to be necessary, but in the stage of system redesigning, the additional loads transferred by cross bracings can be added to the design loads. This may eliminate the need for an expensive and sometimes bothering steel frame [1]. Therefore, establishing a system of steel cross bracing in a way that it has less economic and technical problems seems to be a proper choice. In order to achieve this goal, the use of steel cross bracings which are directly connected to concrete frame Is studied. There are some reports which show the application of this method in practice [2] and experimental [3] models in Iran. In this cross bracing system, the details of cross bracing connection to the frame have significant effect on the behavior of the system and need to be studied and investigated thoroughly. In this investigation, identical reinforced concrete frames with similar cross bracing elements with different details for the connection of cross bracing to the frames, are constructed and tested.

Fig.1.1. Concrete Jacketing of Column.

II. RELATED STUDY:

Retrofit strategy refers to options of increasing the strength, stiffness, and ductility of the elements or the building as a whole. A retrofit strategy is a technical option for improving the strength and other attributes of resistance of a building or a member to seismic forces. The retrofit strategies can be classified under global and local strategies. A global retrofit strategy targets the performance of the entire building under lateral loads. A local retrofit strategy targets the seismic resistance of a member, without significantly affecting the overall resistance of the building. The grouping of the retrofit strategies into local and global are generally not be mutually exclusive. For example, when a local retrofit strategy is used repeatedly it affects the global seismic resistance of the building. It may be necessary to combine both local and global retrofit strategies under a feasible and economical retrofit scheme. Steel cross bracing system in combination with moment resisting frame may cause an increase in the stiffness and strength of the structure. In general, moment resisting frame and cross bracing system have two different performances which differ from each other in their type of deformation against lateral loads. The predominant deformation mode of the cross bracing system is flexural which is like vertical cantilever, although, moment resisting frames usually deforms in shear mode.

Fig.2.1. Steel jacketing of column

III. METHODOLOGY AND MATERIALS:

In low-rise buildings with moment resisting frames which are strengthened by steel cross bracing system, the difference between the deformation modes of frame and cross bracing system is not considerable, and secondary stresses do not have much effect on the stability of cross bracing frame in a severe earthquake [7]. In these buildings, the lateral stiffness of the moment resisting frame can be conservatively neglected, and design the structure assuming that the cross bracing system can carry the lateral loads; or design the cross bracing system for lateral loads excess the moment resisting frame capacity. In high-rise buildings which have both moment resisting and cross bracing systems, each system amends the other's weak points to be improved so that there will be an increase in the stiffness and lateral strength of the structure. Furthermore, the difference between the performances of the two systems will lead to a non-uniform distribution of the shear forces between them. This is done in a way that during the lateral deformation in the structure's moment resisting frame in the lower stories, the frame leans to the cross bracing system, and in the upper stories the moment resisting frame itself prevents the cross bracing system from deformation. Therefore, in these stories the shear forces carried by the moment resisting frame may be more than the whole applied shear forces on the structure, because of the negative effect of the performance of the system in the upper stories. Here, according to the common simple methods, the distribution of the shear forces proportional with the strength of structural elements, will lead to unrealistic results. It should be noticed that since carrying the whole lateral forces by the cross bracing system is not that much reliable, so it is also necessary to take the interaction of both systems into consideration [6]. Regarding the above mentioned points, it should be noticed that in those buildings which are strengthened by steel cross bracing system, the behavior of the combined structure will be totally different from that of the primary structure. Hence, in the design of cross bracing systems, proper choice of the changes of response modification factor (R) of the building should be taken into consideration thoroughly. It is not merely poor quality of materials and damage of structural elements serves as the reasons to retrofit a building. Change of the building's function, change of environmental conditions, and change of valid building codes could also be the reasons for retrofitting. Retrofitting must be conducted by experts from each field. In most retrofitting process, an engineer plays the main role. An engineer must assess and analyse the structural capacity. An engineer must also design and suggest the best retrofitting techniques to strengthen the structural deficiencies. The role of the novice is restricted to identify the possibility of insufficiency of the building capacity.

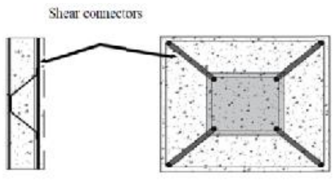

Fig.3.1. Profile of shear connectors between original column and jacket reinforcement.

Steel jacketing refers to encasing the column with steel plates and filling the gap with non-shrink grout. The jacket is effective to remedy inadequate shear strength and provide passive confinement to the column. Lateral confining pressure is induced in the concrete as it expands laterally. Since the plates cannot be anchored to the foundation and made continuous through the floor slab, steel jacketing is not used for enhancement of flexural strength. Also, the steel jacket is not designed to carry any axial load. If the shear capacity needs to be enhanced, the jacket is provided throughout the height of the column. A gap of about 25 to 50 mm is provided at the ends of the jacket so that the jacket does not carry any axial load. For enhancing the confinement of concrete and deformation capacity in the potential plastic hinge regions, the jacket is provided at the top and bottom of the column. Of course there is no significant increase in the stiffness of a jacketed column. Steel jacketing is also used to strengthen the region of faulty splicing of longitudinal bars. As a temporary measure after an earthquake, a steel jacket can be placed before an engineered scheme is implemented.

IV. EXPERIMENTAL ANALYSIS:

The input and output conventions used correspond to common building terminology with ETABS, the models are defined logically floor-by-floor, column-by-column, bay-by-bay and wall-by-wall and not as a stream of non-descript nodes and elements as in general purpose programs. Thus the structural definition is simple, concise and meaningful. In most buildings, the dimensions of the members are large in relation to the bay widths and story heights. Those dimensions have a significant effect on the stiffness of the frame. ETABS corrects for such effects in the formulation of the member stiffness, unlike most general-purpose programs that work on centerline-to-centerline dimensions. The results produced by the programs should be in a form directly usable by the engineer.

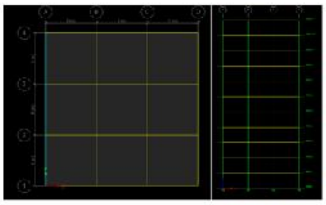

Fig.4.1. PLAN and ELEVATION of Building.

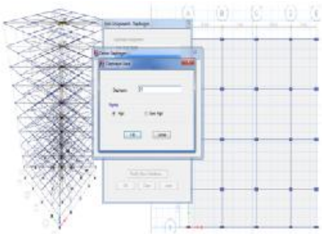

Fig.4.2. Defining Diaphragm action.

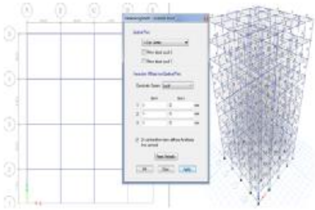

Fig.4.3. Insertion point.

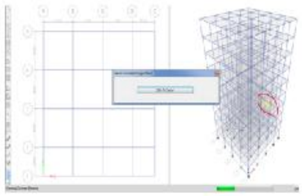

Fig.4.4 Concrete frame design.

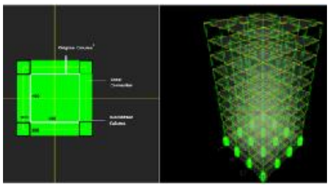

Fig.4.5. Concrete Jacketing for column.

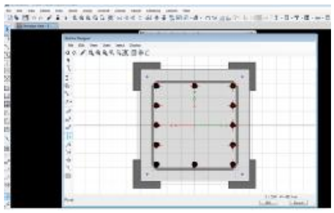

Fig.4.6. Steel Jacketing for column.

Based on the results obtained from the response spectrum analysis of a six(G+10) storey RC framed building, trends in the responses of columns are observed for three types of column jacketing and are presented here term of bending moments(mx and my),shears and axial forces. Besides this the response of the total building in terms of top storey displacements, Inter-storey Drifts and lateral loads on to stories is observed and presented.

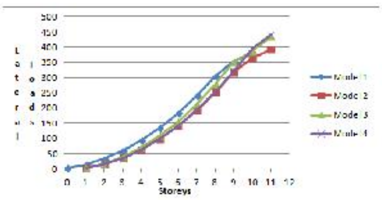

Fig.4.7. Storey vs Lateral loads on each storey.

V. CONCLUSION:

Increase in moments and axial forces were observed in Model 1 (structure which is upgraded to Zone 3). Therefore we can say that size of existing columns is not sufficient to take the loads, hence accordingly column sizes are increased to make the structure safe. It has been observed that the entire jacketing models has less time period than normal RCC structure, but the least time period was found in FRP, from which we can say that FRP jacketing model is more stiffer than RCC and steel jacketing. From the displacements and drifts ratio graphs, it was observed that, the displacement and drifts ratio is drastically reduced in FRP Jacketing (Model 4) and Steel Jacketing (Model 3) models when compared to normal RCC structure (Model 1). Hence significant effect of RCC, Steel and FRP jacketing was observed. Therefore RCC, Steel and FRP jacketing models has better performance. Hence we can conclude that FRP jacketing is more effective in increasing both strength and deformation capacity of the retrofitted columns.

VI. REFERENCES:

[1]. Badoux, M., and Jirsa, J.O. (1990). Steel Bracing of RC Frames for Seismic Retrofitting. Journal of Structural Engineering, ASCE, 116:1, 55-74.

[2]. Canales, M.D., and Briseno de la Vega, R. (1992). Retrofitting Techniques Used in Telephone Buildings in Mexico. Proceedings of 10th World Conference on Earthquake Engineering, Vol. 9, Madrid-Spain, 5143-5147.

[3]. Nateghi-A., F. (1995). Seismic Strengthening of Eight-Story RC Apartment Building Using Steel Braces. Engineering Structures, 17:6, 455-461.

[4]. Pincheira, J.A., and Jirsa, J.O. (1995). Seismic Response of RC Frames Retrofitted with Steel Braces or Walls. Journal of Structural Engineering, ASCE, 121:8, 1225-1235.

[5]. Sugano, S. (1992). Research and Design for Seismic Retrofit of Existing Buildings in Japan. Memoria Proceedings: International Symposium on Earthquake Engr. Disaster Prevention, U.N. Center for Disaster Prevention, Vol. 2, 91-106.

[6]. Wyllie, L.A., Dal Pino, J.A. and Cohen, J. (1991). Seismic Upgrade Preserves Architecture. Modern Steel Construction, Permit No. 4, 20-23.

[7]. Goel, S.C., and Lee, H.S. (1990). Seismic Strengthening of Structures by Ductile Steel Bracing System. Proceedings of 4th U.S. National Conference on Earthquake Engineering, Vol. 3, Palm Springs, California, 323-331.

[8]. Higashi, Y., Endo, T. and Shimizu, Y. (1984). Experimental Studies on Retrofitting of Reinforced Concrete Building Frames. Proceedings of 8th World Conference on Earthquake Engineering, Vol. 1, San Francisco, 477-484.

